Virginia
Standards of Learning Assessments

Spring 2001 Released Test

(Supplemental Information)

End of Course

Chemistry

Property of the Virginia Department of Education

End of Course

Introducing the Virginia Standards of Learning

Chemistry

One of the complete test forms from the Spring 2001 Standards of Learning administration is presented in the following pages. The intent of this released test is to provide parents and teachers additional information to accompany the Student Performance Report and/or the Parent Report.

The information accompanying each test question is broken into several components:

Reporting Category: Matches the score report and allows for identification of strengths and weaknesses indicated by student scores.

Standard of Learning: Presents the SOL used in developing the assessment question.

Instruction: Provides information for teachers to use as the SOL is incorporated into instruction.

The answer to each question can be found at the back of the booklet.

Chemistry

End of Course

Reporting Category: Scientific Investigation

A. Standard of Learning: CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include:

a) designated laboratory techniques.

Builds On: Work with variables begins in the fifth grade SOL and increases in complexity throughout the study of science SOL.

A

1 To remove the sand first and then the salt from a mixture of sand and salt water, one combination of techniques you could use would be to *first* —

A evaporate and then distill
B evaporate and then condense
C filter and then evaporate
D filter and then condense

Instruction: Provide students an opportunity to practice lab techniques including filtration.

B. Standard of Learning: CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include:

b) safe use of chemicals and equipment.

Builds On: Work with variables begins in the fifth grade SOL and increases in complexity throughout the study of science SOL.

B

2 A student must make a 3 M acid solution using a 5 M acid solution. Which of these is the safest way to make the solution?

F Slowly pour the 5 M acid into water
G Slowly add water to the 5 M acid solution
H Mix half the acid with water, then add the remaining water
J Mix half the water with the acid, then add the remaining acid

Instruction: Provide students an opportunity to consider laboratory safety for an experiment involving water and acid.

Chemistry

End of Course

A. Standard of Learning: CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include:

c) proper response to emergency situations.

Builds On: Work with variables begins in the fifth grade SOL and increases in complexity throughout the study of the science SOL.

A

3 What is the first step that should be taken when a caustic chemical gets into a person's eye?

A Identify the chemical
B Call for an ambulance
C Flush the affected area with water
D Apply a neutralizing agent

Instruction: Provide students an opportunity to study and understand the safe use of chemicals.

Chemistry

End of Course

A. Standard of Learning: CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include:

d) multiple variables are manipulated with repeated trials.

Builds On: Work with repeated trials with variables begins with the sixth grade SOL and increases in complexity throughout the study of the science SOL.

A

4 A student wanted to calculate the formula for hydrated copper sulfate. After careful massing, she heated the compound to remove the water. She calculated the formula to be $CuSO_4 \cdot 4H_2O$. The actual formula was $CuSO_4 \cdot 5H_2O$. What is the most likely source of analytical error in the student's experiment?

F The water was not completely evaporated from the compound.

G The actual mass of the anhydrous $CuSO_4$ was less than the measurement.

H The $CuSO_4$ reacted with elemental copper.

J The atmospheric pressure prevented complete reaction.

Instruction: Provide students an opportunity to analyze the quantitative error in experiments dealing with mass.

Chemistry

End of Course

A. Standard of Learning: CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include:

g) mathematical manipulations (SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, dimensional analysis, use of scientific calculator).

Builds On: Work with manipulation of variables in experiments begins with the third grade SOL and increases in complexity throughout the study of science.

A

5 The element chlorine exists as two naturally occurring isotopes. Cl-35 occurs 75% of the time and Cl-37 occurs 25% of the time. Which of the following calculations should be used to calculate the correct average atomic mass of chlorine?

A $(35 \text{ amu} \times .75) + (37 \text{ amu} \times .25)$

B $\dfrac{(35 \text{ amu} \times 3) + 37 \text{ amu}}{2}$

C $\dfrac{(35 \text{ amu} \times 3) + 37 \text{ amu}}{3}$

D $\dfrac{35 \text{ amu} + 37 \text{ amu}}{2}$

6 The mass of an object was recorded as 9.93 g, 9.90 g, and 10.02 g, using an electronic analytical balance. What is the average of these three masses expressed to the correct number of significant figures?

F 9.9 g
G 9.95 g
H 10.0 g
J 10.00 g

7 Which of these shows a volume of 1.25 liters expressed in milliliters?

A 125 mL
B 12.5×10^1 mL
C 1.25×10^2 mL
D 1.25×10^3 mL

8

Group	Mass Data for Sample X (g)	Displacement Data for Sample X (mL)
1	2.7	3.4
2	1.20	1.5
3	6.2	7.40

According to the above data, which of the following represents the average density for sample X using the correct number of significant figures?

F 1 g/mL
G 0.8 g/mL
H 0.81 g/mL
J 0.821 g/mL

Instruction: Provide students an opportunity to analyze experimental data including: determine the average of three given masses to the appropriate number of significant figures; convert a volume reading in liters to milliliters; and for a group of three samples, find the average density to the correct number of significant figures.

Chemistry

End of Course

A. Standard of Learning: CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include:

g) mathematical manipulations (SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, dimensional analysis, use of scientific calculator).

Builds On: Work with mathematical manipulations begins with the third grade SOL and increases in complexity throughout the study of science.

A

9 $NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + CO_2(g) + H_2O(g)$

Data Table

evaporating dish + watch glass	42.70 g
evaporating dish + watch glass + $NaHCO_3$	45.20 g
evaporating dish + watch glass + NaCl	44.45 g

A student conducted an experiment and was interested in the mass of the product of the chemical reaction. Some results of the experiment are shown above. What is the mass of the NaCl?

A 0.75 g
B 1.75 g
C 2.25 g
D 2.50 g

10 What is the percentage of aluminum in aluminum oxide (Al_2O_3)?

F 47%
G 48%
H 53%
J 54%

Instruction: Provide students an opportunity to analyze quantitative data from a scientific experiment to determine the mass of one of the products in a chemical reaction; and to solve a problem involving percent of an element in a compound.

Chemistry

End of Course

Reporting Category: Atomic Structure and Periodic Relationships

A. Standard of Learning: CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of

b) isotopes / half-lives / nuclear particles.

Builds On: Work with atoms and their structures begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

11 Radioactive iodine-131 has a half-life of eight days. The amount of a 200.0 gram sample left after 32 days would be —

A 6.25 g
B 12.5 g
C 25.0 g
D 50.0 g

12 How does the radioactive isotope C-14 differ from its stable counterpart C-12?

F It has a different number of protons and two less neutrons than C-12.
G It has the same number of protons and two more electrons than C-12.
H It has the same number of protons but two more neutrons than C-12.
J It has a different number of protons and two more neutrons than C-12.

Instruction: Provide students an opportunity to use knowledge of half-lives to find the amount of a sample remaining after a given period of time; and to solve a problem requiring knowledge of the difference between two isotopes of an element.

Chemistry

End of Course

A. Standard of Learning: CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of

c) particle / mass charge.

Builds On: Work with atoms and their structures beings with the sixth grade SOL and increases in complexity throughout the study of science.

A

13 Chlorine forms a 1– ion. How many electrons does a chloride ion have?

A 1
B 16
C 17
D 18

Instruction: Provide students an opportunity to identify the composition of an ion based on the number of electrons in a neutral atom.

B. Standard of Learning: CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of

d) families / groups.

Builds On: Work with atoms and their structures begins with the sixth grade SOL and increases in complexity throughout the study of science.

B

14 An element has an electron configuration of $1s^2 2s^2 2p^6 3s^2$. Which of these will be in the same group as this element?

F $1s^2 2s^2 2p^6$
G $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
H $1s^2 2s^2 2p^6 3s^1$
J $1s^2 2s^2 2p^6 3s^2 3p^6$

Instruction: Provide students an opportunity to represent the electron configuration for the outermost energy level of elements in the same group.

Chemistry

End of Course

A. Standard of Learning: CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of

f) trends / patterns: atomic / nuclear radii, electronegativity, shielding effect.

Builds On: Work with atoms and their structures begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

15

Electronegativity Values of Some Atoms

2.1 H						
1.0 Li	1.5 Be	2.0 B	2.5 C	3.0 N	3.5 O	4.0 F
0.9 Na	1.2 Mg	1.5 Al	1.8 Si	2.1 P	2.5 S	3.0 Cl
0.8 K	1.0 Ca				2.4 Se	2.8 Br

Electronegativity differences are often helpful in determining the bond character between two atoms. A general rule states that if the electronegativity difference between two atoms is greater than 1.67, an ionic bond would most likely be formed. Using the chart above, which pair of atoms would probably form the strongest ionic bond?

A Al-P
B Na-Cl
C K-F
D Ca-O

16 Which of these describes a tendency for atomic radii as displayed on the periodic chart?

F Atomic radii decrease left to right across a period.
G Atomic radii increase left to right across a period.
H Atomic radii decrease top to bottom down a group.
J Atomic radii increase, then decrease from top to bottom down a group.

17 Which of these elements is the most chemically active?

A F
B Cl
C Br
D I

Instruction: Provide students an opportunity to utilize the periodic table to predict trends and reactivity of elements.

Chemistry

End of Course

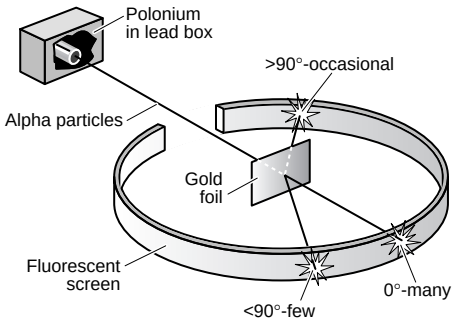
A. Standard of Learning: CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of

i) historical/quantum models.

Builds On: Work with atoms and their structures begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

18



Which of these conclusions can be drawn from Rutherford's experiment?

F Each atom contains electrons.
G The nucleus of an atom can be split.
H Each atom contains protons.
J Atoms are mostly empty space.

Instruction: Provide students an opportunity to investigate Rutherford's contribution to modern atomic theory.

Chemistry

End of Course

Reporting Category: Nomenclature, Chemical Formulas, and Reactions

A. Standard of Learning: CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include:

a) nomenclature.

Builds On: Work with mixtures, compounds, and elements begins with the sixth grade SOL and continues to increase in complexity throughout the study of science.

A

19 Which is the correct formula for iron (III) sulfate?

A $Fe_3(SO_4)_2$
B $FeSO_4$
C $Fe_2(SO_4)_3$
D $Fe_2(SO_3)_3$

20 The formula H_2SO_4 is representative of which of the following?

F A catalyst
G A base
H An acid
J An organic compound

Instruction: Provide students an opportunity to interpret the correct formula for compounds given the name in the Stock system (Roman numerals) and recognize the formula for an acid.

Chemistry

End of Course

A. Standard of Learning: CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include:

b) balancing chemical equations.

Builds On: Work with mixtures, compounds, and elements begins with the sixth grade SOL and continues to increase in complexity throughout the study of science.

A

21

$3MgO + 2Al \rightarrow ?$

What would be the product(s) of this reaction?

A $2Mg_3Al_2O_3$
B $Mg_3Al_2 + 3O_2$
C $6Mg + Al_3O_2$
D $3Mg + Al_2O_3$

Instruction: Provide students an opportunity to predict the products and balance a chemical equation by supplying the reactants for a given reaction.

Chemistry

End of Course

A. Standard of Learning: CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include:

c) writing chemical formulas — molecular, structural, empirical, and Lewis diagrams.

Builds On: Work with mixtures, compounds, and elements begins with the sixth grade SOL and continues to increase in complexity throughout the study of science.

A

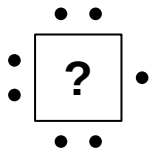
22 A compound is composed of 58.8% C, 9.8% H, and 31.4% O, and the molar mass is 102 g/mol. What is the molecular formula for this compound?

F $C_2H_{10}O_3$
G $C_5H_5O_3$
H $C_5H_{10}O_2$
J CH_3O_3

23 A compound has 50% sulfur and 50% oxygen. What is its empirical formula?

A SO_4
B S_2O_4
C SO_3
D SO_2

24



Which of the groups below has the electron dot structure shown above?

F Noble gases
G Halogens
H Alkali metals
J Transition elements

25 Which of these represents the empirical formula and the molecular formula, respectively, for a given organic compound?

A CH and C_2H_2
B CH and CH_4
C CH_2 and C_2H_2
D CH_3 and C_3H_{12}

Instruction: Provide students an opportunity to determine the molecular formula and empirical formula for a given compound given its quantitative composition; and to practice writing and identifying Lewis diagrams.

Chemistry

End of Course

A. Standard of Learning: CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include:

d) bonding types — ionic, covalent.

Builds On: Work with mixtures, compounds, and elements begins with the sixth grade SOL and continues to increase in complexity throughout the study of science.

A

26 Which compound contains both ionic and covalent bonds?

F NH_4Cl
G $MgBr_2$
H CH_4
J NH_3

27 **Melting and Boiling Points of Some Bond Types**

Substance	Type of Bond	Boiling Point	Melting Point	Phase at 24°C
Helium	atom (monatomic)	-269°C	-272°C	gas
Hydrogen	molecule (nonpolar covalent)	-253°C	-259°C	gas
Iron	atom (metallic crystal)	3000°C	1535°C	solid
Sodium chloride	ionic crystal	1413°C	800°C	solid
Water	molecule (polar covalent)	100°C	0°C	liquid

According to the table, which of these probably has the strongest bonds?

A Hydrogen gas
B Iron crystals
C Sodium chloride
D Water

Instruction: Provide students an opportunity to identify the bonding type in simple compounds and relative bond strengths from tabular data.

Chemistry

End of Course

A. Standard of Learning: CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include:

e) reaction types — synthesis, decomposition, single and double replacement, oxidation-reduction, neutralization, nuclear, exothermic and endothermic, spontaneous / non-spontaneous, dissociation ionization.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

28 **Which is an example of a synthesis reaction?**

F $HCl + KOH \rightarrow KCl + H_2O$
G $Pb(NO_3)_2 + 2HBr \rightarrow PbBr_2 + 2HNO_3$
H $C + O_2 \rightarrow CO_2$
J $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

29

Some Solubilities in Water

Key
i = nearly insoluble
ss = slightly soluble
s = soluble
n = not isolated

	acetate	bromide	carbonate	chloride	chromate	hydroxide
Aluminum	ss	s	n	s	n	i
Ammonium	s	s	s	s	s	s
Barium	s	s	i	s	i	s
Calcium	s	s	i	s	s	ss
Copper (II)	s	s	i	s	i	i
Iron (II)	s	s	i	s	n	i

Using the chart above, which of these combinations will probably form a precipitate?

A Ammonium chloride
B Barium bromide
C Calcium chromate
D Copper (II) carbonate

30

A(s) + B(s) → D(g) + heat

The reaction shown above is —

F an endothermic reaction
G an exothermic reaction
H a decomposition reaction
J a double-replacement reaction

31

Very Active Metal + Water → Metal Hydroxide + ?

Which of these completes this reaction?

A Oxygen
B Hydrogen
C Metal oxide
D Air

Instruction: Provide students an opportunity to predict the type of reaction from a chemical equation; identify the products of simple reactions; and differentiate between exothermic and endothermic reactions given a chemical equation.

Chemistry

End of Course

A. Standard of Learning: CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include:

g) reaction rates and kinetics: activation energy, catalysis, degree of randomness.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

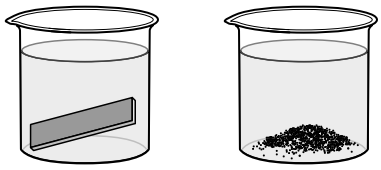
32 If the temperature of a reaction is increased, the reaction proceeds at a much quicker rate because the —

- **F** activation energy increases
- **G** energy of the products increases
- **H** frequency of collisions between reactants increases
- **J** energy of the activated complex increases

33 A catalyst accelerates a chemical reaction because the —

- **A** catalyst decreases the number of collisions in a reaction
- **B** activation energy of the reaction is lowered in the presence of a catalyst
- **C** catalyst decreases the concentration of the reactants
- **D** temperature of the reaction increases due to the catalyst

34



Beaker A Beaker B

Each beaker shown above contains 2.2 grams of iron and 1 liter of 3M H_2SO_4 at STP. Which reaction will go to completion first and why?

- **F** Beaker A because of increased surface area
- **G** Beaker B because of increased surface area
- **H** Beaker A because of a higher concentration level
- **J** Beaker B because of a higher concentration level

Instruction: Provide students an opportunity to investigate variables that increase reaction rates.

Chemistry

End of Course

Reporting Category: Molar Relationships

A. Standard of Learning: CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include:

a) Avogadro's principle, molar volume.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

35 Which volume will be occupied by a gas containing 6.02×10^{23} atoms at STP?

A 1.0 L
B 11.2 L
C 22.4 L
D 44.8 L

Instruction: Provide students an opportunity to understand the quantitative meaning of Avogadro's principle.

Chemistry

End of Course

A. Standard of Learning: CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include:

b) stoichiometric relationships.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

36 $2H_2S\ (g) + 3O_2\ (g) \rightarrow 2H_2O\ (g) + 2SO_2\ (g)$

If 3.50 g of H_2S are used in the above reaction, what will be the theoretical yield of water in grams?

F 0.102 g
G 0.185 g
H 1.85 g
J 185 g

37 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

The number of grams of oxygen required for the complete combustion of 4.00 grams of methane (CH_4) is —

A 4.00 g
B 8.00 g
C 16.0 g
D 32.0 g

Instruction: Provide students an opportunity to utilize balanced equations in calculating mass problems.

B. Standard of Learning: CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include:

e) solution concentrations.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

B

38 A solution contains 225 g of glucose, $C_6H_{12}O_6$, dissolved in enough water to make 0.825 L of solution. What is the molarity of the solution?

F 0.66 M
G 0.97 M
H 1.03 M
J 1.52 M

39 How many milliliters of 2.00 M H_2SO_4 are needed to provide 0.250 mole of H_2SO_4?

A 125 mL
B 1.25×10^1 mL
C 8.00×10^3 mL
D 8.00 mL

Instruction: Provide students an opportunity to calculate molarity including solution concentrations.

Chemistry

End of Course

A. Standard of Learning: CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include:

f) chemical equilibrium.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

40 In the reaction $2SO_2$ (g) + O_2 (g) ⇔ $2SO_3$ (g), which change would cause the greatest increase in the concentration of SO_3?

F Decrease the concentration of SO_2
G Decrease the concentration of O_2
H Increase the concentration of SO_2
J Increase the concentration of O_2

Instruction: Provide students an opportunity to predict how changing the concentration of one of the reactants in a chemical reaction will affect the products.

Chemistry

End of Course

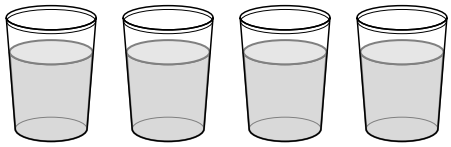
A. Standard of Learning: CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include:

g) acid / base theory: strong / weak electrolytes, dissociation / ionization (pH, poH), and titration.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

41 **I** **II** **III** **IV**



Four aqueous solutions and their concentrations are shown in the above illustration. Which of the solutions is most likely to be the strongest conductor of electricity?

A I
B II
C III
D IV

42 **The hydrogen ion concentration is 1×10^{-7}. What is the pH of this solution?**

F 1
G 7
H 10
J 14

Instruction: Provide students an opportunity to determine pH value of a solution given its hydrogen ion concentration; and given several solutions of different molar concentrations and / or different substances, choose which is most likely to be the strongest conductor of electricity.

Chemistry

End of Course

Reporting Category: Phases of Matter and Kinetic Molecular Energy

A. Standard of Learning: CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include:

a) pressure, temperature, and volume.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

43 If the pressure exerted on a confined gas is doubled, then the volume of the gas —

A increases four times
B decreases by one-fourth
C is doubled
D is halved

44 One of the main assumptions of the kinetic molecular theory of gases is that the particles of an ideal gas —

F must be single atoms instead of molecules
G are in constant motion
H must be maintained at very high pressures
J must be highly chemically reactive

45 Water can be made to boil *above* its normal boiling point of 100°C by —

A decreasing the air pressure
B increasing the air pressure
C increasing the heat being applied
D decreasing the volume of the container

46 The average kinetic energy of a sample of water molecules is —

F increased as the temperature is decreased
G increased as the temperature is increased
H unaffected by temperature changes
J always equal to zero

Instruction: Provide students an opportunity to apply Boyles law to determine a volume for a specified change in pressure; test students understanding of the Kinetic molecular theory of gases; test students understanding of boiling point as related to pressure; and provide an opportunity for students to understand the relationship between temperature and the average kinetic energy of a substance.

Chemistry

End of Course

A. Standard of Learning: CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include:

c) partial pressures.

Builds On: Work with changes in chemical composition begins with the sixth grade SOL and increases in complexity throughout the study of science.

A

47 A sample of oxygen gas is collected over water at 22°C and 98.67 kPa pressure. If the partial pressure of the water is 2.67 kPa, the partial pressure of the oxygen is —

A 93.33 kPa
B 96.00 kPa
C 98.66 kPa
D 101.33 kPa

Instruction: Provide students an opportunity to determine the partial pressure of a gas in kPa when the gas is collected over water.

Chemistry

End of Course

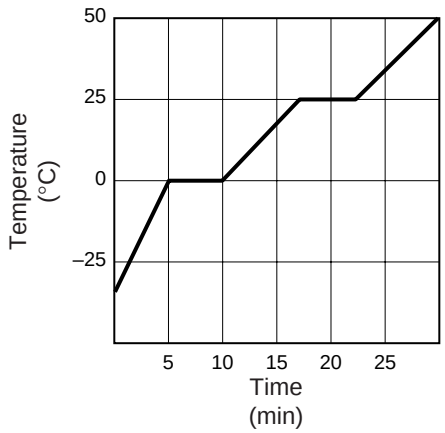
A. Standard of Learning: CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include:

d) phase changes.

Builds On: Work with the kinetic theory begins in Physical Science in the eighth grade and increases in complexity throughout the study of science.

A

48



An experiment yielded the above temperature and time information. What is the freezing point of the material in this experiment if the material is a solid at time zero?

F −25°C
G 0°C
H 25°C
J 50°C

Instruction: Provide students an opportunity to develop and interpret a phase change graph.

Chemistry

End of Course

A. Standard of Learning: CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include:

e) molar heats of fusion and vaporization.

Builds On: Work with vaporization and heat transfer begins in Physical Science in eighth grade and increases in complexity throughout the study of science.

A

49 If the heat of fusion of water is 3.4×10^2 J/g, the amount of heat energy required to change 15.0 grams of ice at 0°C to 15.0 grams of water at 0°C is —

A 3.4×10^2 J
B 2.4×10^3 J
C 5.1×10^3 J
D 1.0×10^4 J

Instruction: Provide an opportunity to calculate energy changes involving the heat of fusion and heat of vaporization.

Chemistry

End of Course

A. Standard of Learning: CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include:

f) specific heat capacity.

Builds On: Work with heat transfer begins in Physical Science in eighth grade and increases in complexity throughout the study of science.

A

50 **Specific Heat Capacities of Some Common Substances**

Substance	Specific Heat Capacity (cal/g • °C)
Aluminum	0.21
Alcohol	0.58
Water	1.00
Wood	0.42

What probably causes water to have the highest specific heat of the substances listed above?

F Molecule size
G Molecular mass
H Strong hydrogen bonds
J High density of ice

Instruction: Provide students an opportunity to interpret a chart with information about specific heat capacity and determine what probably causes one substance to have the highest specific heat.

End of Course

Correct Answers

CHEMISTRY TEST

1. C **2.** F **3.** C **4.** F **5.** A **6.** G **7.** D **8.** H **9.** B **10.** H
11. B **12.** H **13.** D **14.** G **15.** C **16.** F **17.** A **18.** J **19.** C
20. H **21.** D **22.** H **23.** D **24.** G **25.** A **26.** F **27.** B **28.** H
29. D **30.** G **31.** B **32.** H **33.** B **34.** G **35.** C **36.** H **37.** C
38. J **39.** A **40.** H **41.** B **42.** G **43.** D **44.** G **45.** B **46.** G
47. B **48.** G **49.** C **50.** H